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BULLETIN

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OF THE

AMERICAN PHYSICAL SOCIETY

PROGRAM

FOR THE

UNIVERSITY OF CALIFORNIA AT LOS ANGELES MEETING

AT

LOS ANGELES, California

DECEMBER 19, 1938

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The American Physical Society

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LOS ANGELES MEETING, DECEMBER 19, 1938

THE 224th regular meeting of the American Physical Society will be held in Los Angeles, California, on Monday, December 19, 1938, in the Department of Physics of the University of California at Los Angeles.

Luncheon. A luncheon for attending physicists and friends will be held at 12:30 P.M. Monday, December 19 in Kerckhoff Hall on the University campus. Visiting members of the American Physical Society will be guests of the University upon this occasion. The attendance of interested non-members, at their own expense, will be welcomed.

Washington Meeting. The preliminary arrangements of the Washington program include a joint dinner with the American Association of Physics Teachers on Wednesday evening, December 28th. There will also be an address by the President of the American Physical Society, Dr. Lyman J. Briggs, on Wednesday afternoon, December 28th. The subject of his address will be "The National Standards of Measurements" and it will be followed by an inspection of the standards in the laboratories.

General Rules Relating to Papers

Only those titles of papers shall be listed on the preliminary program of a meeting of the Society for which abstracts ready for publication are in the hands of the Secretary.

On December 28, 1936, the Society voted that:

No papers may be accepted for presentation at any meeting of the Society subsequent to the closing date stated in the printed call for that meeting.

When two or more papers are offered by the same member, one only of these will be assigned a place on the regular program, while the others will be placed in a supplementary program. (A paper presented by two or more authors is assigned to the first named author.)

All supplementary papers will be grouped according to subject matter and will be called for at their appropriate sessions only, these sessions to be designated on the program. The presiding officer may assign a reduced time to these papers or may in his discretion call for them to be read by title only.

Except by special vote of the Society, the maximum allowance of time for the presentation of a paper shall be ten minutes. The presiding officer shall enforce this rule.

Titles and abstracts of the papers to be presented are given in the following pages. These abstracts have not been corrected by the authors. After correction the abstracts will be published in an early number of the *Physical Review*. Authors should send corrections to the Publications Manager, The American Institute of Physics Incorporated, 175 Fifth Avenue, New York, N. Y.

Other meetings for the current season are as follows:

225. December 27–29, 1938. Annual Meeting. Washington, D. C.
226. February 24–25, 1939. New York, N. Y.
227. Washington, D. C. April, 1939.
228. Pacific Coast. June, 1939.
229. June, 1939. Summer meeting.

PAUL KIRKPATRICK
Local Secretary for the Pacific Coast
Stanford University, California.

December 5, 1938.

DEC - 6 1938

CALENDAR

Monday morning, December 19.
9:30 o'clock: Physics Department: Papers No. 1–9, pages 4–6.
Monday noon, December 19.
12:30 o'clock: Kerckhoff Hall: luncheon.

Monday afternoon, December 19.
1:30 o'clock: Physics Department: Papers No. 10–19, pages 6–8.

PROGRAM

MONDAY MORNING, 9:30 O'CLOCK

Physics Department

1. Distribution of Eigentones at Low Frequencies. RICHARD H. BOLT, *University of California at Los Angeles (Introduced by Joseph Kaplan).*—Rayleigh presented an asymptotic formula for the number of characteristic frequencies or eigentones, N, per unit volume, up to a given frequency, ν, and the derivative form which gives the number of eigentones in the range ν to $\nu+d\nu$. This dN form was applied successfully to quantum radiation laws.[1] It is shown that these simple formulae do not apply accurately to sound waves, especially in small rooms and at low frequencies. The discrepancy is attributable to the small number of eigentones involved, compared to the number usually concerned in the case of electromagnetic radiation. More accurate expressions are derived, for a rectangular room, from a consideration of the density of characteristic points in frequency space. The new formulae are:

$$N=\frac{4\pi V}{3c^3}\nu^3\left[\frac{2V\nu+cR^{\frac{1}{2}}}{2V\nu+(c/2)R^{\frac{1}{2}}}\right]^3$$

and, after expansion and simplification:

$$dN=\frac{4\pi V}{c^3}\left[\nu^2+\frac{cR^{\frac{1}{2}}}{2V}\nu\right]d\nu,$$

where $R=(L_xL_y)^2+(L_yL_z)^2+(L_zL_x)^2$; L_x, L_y, L_z are the dimensions of the rectangular room, V is its volume, and c is the velocity of sound. These new equations fit the "exact," stepped curves very nicely, even for the first few eigentones. This development has certain practical applications in acoustics. A new expression is given for the average sound energy, in a room, as a function of frequency. Preliminary experimental confirmation has been obtained.

[1] Richtmyer, *Introduction to Modern Physics*, p. 221–6; p. 237.

2. Conservation of Momentum in Electrical Conductivity. W. V. HOUSTON, *California Institute of Technology.*—For a number of years the theory of electrical conductivity has been marred by a conservation theorem of Peierls. This theorem established the invariance of a function of the electron wave numbers and the lattice vibrations of the crystal, and seemed to indicate for metals at low temperatures a much larger conductivity than is observed. An alternative explanation of the observations was based on the existence of "umklapp" processes by which the conserved quantity could change by an integer. The effective intervention of such processes required, however, a rather special distribution of energy levels as a function of the electron wave numbers. It can be shown that if the Hamiltonian function is properly selected to guarantee the conservation of momentum the theorem of Peierls is merely a part of the conservation of momentum. Its rather peculiar form is associated with the fact that the assumption of periodicity in the crystal lattice restricts its momentum to a series of discrete values. The "umklapp" processes can then be regarded as occurring in the lattice, rather than with the electrons, and representing the transfer of momentum to the lattice.

3. The Quadratic Zeeman Effect. F. A. JENKINS AND E. SEGRÈ, *University of California.*—This effect is a violet shift of the Zeeman components of a line proportional to the square of the magnetic field. It is predicted by the theory of diamagnetism, but has not heretofore been satisfactorily observed. Theoretically the displacement is proportional to n^4, and hence should be detected in the lines of series running to high n. We have studied the Zeeman effect of the higher members of the principal series of Na and K, using a column of absorbing vapor 30 cm long in the new 60-in. cyclotron magnet of the Crocker Radiation Laboratory. With a field of 27,000 gauss, the quadratic effect becomes detectable at about $n=10$, and follows the simple theory accurately to $n=20$. Beyond this there is an additional violet shift, smaller in K than in Na, which is attributed to the perturbation of the ^2P states by the ^2F, ^2H $\cdots$ states, since these come close to the ^2P states in this region. The measured perturbations agree quantitatively with the calculations of Schiff and Snyder (see following abstract) as far as $n=26$. Here the lines begin to broaden rapidly toward the red,

until they merge into a continuum at $n=35$. The various features of this broadening agree with the conclusion of Schiff and Snyder that it is caused by the interaction of states of different n.

4. On the Theory of the Quadratic Zeeman Effect. H. SNYDER AND L. I. SCHIFF, *University of California.*—The quadratic Zeeman effect observed by Jenkins and Segrè (see preceding abstract) in absorption to large orbits in strong magnetic fields is caused by the diamagnetic term in the Hamiltonian, proportional to the square of the vector potential. For the alkalis, the problem involves essentially only one electron, and its spin can be ignored. m_l and parity are always exactly defined, while n and l are not. The observed spectrum can be divided up with increasing n into three regions, according as the lines are broadened asymmetrically (region I), broadened further, but nearly symmetrically (region II), and broadened so much as to overlap into a continuum (region III). It is shown that region I corresponds to n being a good quantum number and l a fairly good one; region II to n being a fairly good quantum number and l not good at all; and region III to both n and l breaking down completely as quantum numbers. Good quantitative agreement with the experiments is obtained as long as inter-n perturbations can be neglected. When this can no longer be done (large n), the theory becomes prohibitively complicated, although some qualitative indications can still be obtained from it.

5. The Fine Structure of Hα and Dα. SIMON PASTERNACK, *California Institute of Technology.*—Kemble and Present[1] pointed out that the discrepancy between the experimental and theoretical values for the doublet separations of Hα and Dα could be accounted for by a large deviation from the Coulomb law at small distances from the nucleus, which leads to a displacement of the S levels. Later experimental work[2] indicated a departure from the theoretical positions of both components (2) and (3) relative to (1). More recently Williams[3] obtained for Dα the separations 0.319 cm^{-1} between components (1) and (2), and 0.135 cm^{-1} between components (3) and (2), these values being, respectively, smaller and greater than the theoretically predicted values. Both of these deviations can be explained on the basis of a displacement of the $2\,^2S$ level of deuterium. Such a displacement would seem to imply a repulsive interaction between the electron and proton at small distances. A first order perturbation treatment indicates that an extremely large interaction would be required to account for the displacement.

Observations by Chu on He II are not in contradiction with an S level displacement. Also, a very small discrepancy found by Edlén[4] in the wave-length of the Li III line $1s\,^2S-2p\,^2P$ can be accounted for by an S level displacement, using the first order perturbation treatment together with an interaction indicated by the Dα perturbation.

[1] Kemble and Present, Phys. Rev. **44**, 1031 (1932).
[2] Houston, Phys. Rev. **51**, 446 (1937).
[3] Williams, Phys. Rev. **54**, 558 (1938).
[4] Edlén, *Wellenlängen und Termsysteme zu den Atomspektren der Elemente Li, Be, B, C, N, O* (Uppsala, 1934), p. 29.

6. A Continuously Sensitive Diffusion Cloud Chamber. ALEXANDER LANGSDORF, JR.,* *University of California.*—Photographs of ion-tracks have been obtained with the thermally activated diffusion cloud chamber previously described,[1] in which vapor diffuses vertically downward through a gas from a heated top plate to a refrigerated floor plate. The diffuse rain of condensation previously reported has been nearly eliminated by heating liquid in a glass flask by radiation from above the flask, to produce vapor free of aggregates. The ion-sensitive region is about three inches deep in a chamber six inches deep. The maximum steady ion-load the present chamber can carry and still show tracks has been determined approximately, and is not much greater than the normal background ionization without shielding. An analysis of the operation of the chamber has been made. Some precautions necessary for successful operation, and some limitations upon the use of this type of apparatus are now rather well known.

* National Research Fellow.
[1] A. Langsdorf, Jr., Phys. Rev. **49**, 422(A) (1936); **51**, 1026(A) (1937).

7. Faint *L*-series Lines from *K* Auger Transitions in Silver. CECIL J. BURBANK, *Stanford University.*—By using a single-crystal vacuum spectrograph weak lines having wave-lengths of 4.030A, 4.016A and 3.805A have been obtained from a thin silver target bombarded with 80-kv electrons. These lines are located among the L lines of silver but L critical potentials do not suffice to produce them; in no case have they been observed except with electron energies exceeding the K excitation energy. This fact, and the observed wave-lengths, are in agreement with the supposition that the condition prerequisite for such an emission is a double L ionization resulting from Auger processes succeeding direct K ionization by a cathode electron. The low observed intensities are also consonant with this explanation. The wave-lengths given above have been assigned respectively to the transitions $L^2_{III}-L_{III}M_V$, $L^2_{II}-L_{II}M_{IV}$, $L^2_{III}-L_{III}N_V$. These lines are much farther removed from related diagram lines than are previously observed satellites. Their observation is rendered difficult by the intense background of high voltage continuous spectrum which appears in high orders of reflection.

8. On the Equilibrium of Massive Neutron Cores. G. M. VOLKOFF, *University of California.*—Equilibrium of spherically symmetric distributions of matter obeying the equation of state appropriate to a cold degenerate Fermi gas has been studied by using the gravitational theory of general relativity. It has been found that with this equation of state a single quasi-Newtonian spherically symmetric stable equilibrium configuration exists for distributions with total mass between O and M_1, two equilibrium configurations, one of which is stable and the other unstable, exist for masses greater than M_1 and less than M_2, and no equilibrium configurations exist for masses greater than M_2, where M_1 and M_2 are inversely proportional to the square of the mass of the elementary particles composing the Fermi gas. For a cold neutron gas

$M_1 \sim \frac{1}{2} M_\odot$ and $M_2 \sim \frac{3}{4} M_\odot$ ($M_\odot$ = sun's mass). No physically plausible modifications of the equation of state seem essentially to alter this conclusion, or to change radically the order of magnitude of M_2. Nonstatic solutions for the cases $M > M_2$ are being investigated at present.

9. Positive Point-to-Plane Corona Onset Studies. ARTHUR F. KIP, *University of California.*—Positive point-to-plane corona studies[1] have been continued with special emphasis on pre-onset and Geiger counter regions. Oscillographic and photographic studies show two kinds of current pulses occurring below onset voltages. Both types of pulses can be observed by inductive effects on a plate placed near the gap and by the ion currents produced. At lowest voltages for counting action, pulses lasting for about 0.003 second are recorded on the oscillograph and are accompanied by a glow around the point as described by Trichel[2] for steady corona. These correspond to the regular corona process continuing for several thousand bursts after which space charge modification of the field causes extreme likelihood of extinction. At voltages approaching corona onset, *streamers* are observed which extend far out into the gap and which can propagate only into a space charge free gap. The steady corona process is normally initiated by one of these streamers. Streamers occurring just prior to spark breakdown of the gap are associated with the pre-onset streamers. In this case the higher voltage near breakdown gives the high field necessary for streamer propagation despite space charge modification of the field.

[1] Kip, Phys. Rev. **54**, 139 (1938).
[2] G. W. Trichel, Phys. Rev. **54**, 242 (1938).

MONDAY AFTERNOON, 1:30 O'CLOCK

Physics Department

10. On the Paths of Ions in the Cyclotron. L. I. SCHIFF, *University of California.*—Thomas[1] has recently shown that a variation of the magnetic field of a cyclotron with polar angle, together with a radial increase in the field, can produce a focusing effect on the beam while maintaining resonance. For polar angle variations of period 2π or π, the orbits are unstable, while for period $\pi/2$ they are stable. The calculations are here extended to polar angle variations of period $2\pi/3$, and it is shown that the orbits are stable. Compared with the $\pi/2$ period, smaller variations both with polar angle and with radius are required to produce focusing with resonance; the combination of longer period and smaller variation would make such a field easier to construct. The stability of orbits in the electric field due to "triants" operated by three-phase power is also investigated. It is found that if δ is the ratio of the distance between the center of the orbit and the center of the cyclotron to the radius of the orbit, those orbits are stable which are out of phase by an angle somewhat greater than δ; those orbits that are in phase, or out of phase by an angle not greater than δ, are unstable.

[1] L. H. Thomas, Phys. Rev. **54**, 580, 588 (1938).

11. Multiple Scattering of Cosmic-Ray Particles in 1 cm of Platinum. JOSEPH A. VARGUS, *California Institute of Technology.*—451 photographs of cosmic-ray tracks, including many previously used for energy loss measurements, have been measured. The scattering angles and energies observed are compared with the theoretical calculations of Williams. 361 particles (>500 Mev) showed a mean angle of scattering and a distribution in rough accord with theory. It is necessary to use the energy-distribution of Anderson and Neddermeyer[1] for these tracks, whose energies could not be measured; no single curve for any one assumed mean energy can be made to fit the data. Blackett and Wilson[2] have already reported a distribution in the low energy range in accord with theory, and the distribution is now extended to higher energies. 90 particles of measurable energy (<500 Mev) showed a mean angle of scattering roughly in agreement with theory. In disagreement with Blackett and Wilson, however, the distribution of scattering angles in the low energy range indicates an excess of particles scattered at small and at large angles. The departure, though marked, could possibly lie within the limits of error. The discrepancy is similar to that found by Fowler[3] for scattering of electrons (5–17 Mev).

[1] *International Conference on Physics*, vol. 1 (1934), p. 173.
[2] Proc. Roy. Soc. **A165**, 209 (1938).
[3] Phys. Rev. **51**, 773 (1938).

12. The Measurement of γ-Ray Energies. D. C. KALBFELL, *University of California.*—A magnetic electron spectrograph has been constructed to measure the energies of γ-rays from artificially radioactive materials. A photographic plate is used as detector. The γ-rays give rise to electrons either by internal conversion in the radioactive atom itself, or by the photoelectric effect in a thin strip of lead or gold. A number of cases of internal conversion in artificial radioelements are now known and some of these have already been photographed. Ga^{67} was the first substance tried. Lines due to conversion in both the K and L electron shells were observed and indicated a γ-ray of 100 kv. An isotope of element 43 (half-life 6 hours) gave lines from a 129 kv γ-ray. A mixture of long-lived (half-lives greater than 30 days) isotopes of element 43 showed lines from two γ-rays of energies 87 kv and 184 kv. These electron groups have not been previously reported and it is not yet known with what periods they are associated. These last two γ-rays were also measured by using the photoelectrons knocked out of a gold foil by the unconverted fraction of the γ-rays. The energy measured in this way checked up with that determined from internal

conversion. The annihilation radiation from Cu^{64} and N^{13} has also been measured by use of the photoelectrons from lead.

13. Abundance of Interstellar Atoms and Ions. R. M. LANGER, *California Institute of Technology.*—The recent[1] estimate of the strength of nebular hydrogen emission lines provides data needed for the calculation of the abundance of various ionic species known to exist in interstellar space. The computation is based on a previous investigation by the present writer of the intensity and spectral distribution of starlight in our galactic neighborhood. The degree of ionization of the gaseous matter is determined with the help of the dubious but usual assumption of equilibrium between the photoionization due to starlight and the recombination between ions and electrons. Relative abundances in qualitative agreement with observation had already been obtained and from the work of Struve and Elvey the electron concentration could be obtained by calculating the degree of ionization of the hydrogen. The results are in accordance with general

Ionic Species	e	H^+	H	Na
Number per cm³	1.5	1.5	10^{-2}	10^{-7}
Density in g/cm³	10^{-27}	3×10^{-24}	1.6×10^{-26}	4×10^{-30}

Ionic Species	Na^+	Ca	Ca^+	Ca^{++}
Number per cm³	10^{-2}	2×10^{-12}	10^{-7}	3×10^{-5}
Density in g/cm³	4×10^{-26}	1.3×10^{-24}	6×10^{-30}	2×10^{-27}

notions excepting that the low abundance of neutral Ca makes it difficult to understand the presence of the arc lines of Ca in interstellar spectra.

[1] O. Struve and C. T. Elvey, Astrophys. J. **88**, 364 (1938).

14. Nocturnal *E*-Layer Ionization. N. E. BRADBURY, *Stanford University.*—The existence of weak nocturnal *E*-layer ionization is difficult to explain on the basis of a purely solar ultraviolet light hypothesis since radically different values of the recombination coefficient are required during the day and night. Accordingly it is suggested that the nocturnal *E*-layer arises in the same process suggested by Dauvillier which produces the general nonpolar aurora. Pertinent experimental data are meager, but it may be noted that: (1) The nocturnal variation of the *E* layer at Huancayo is similar to the variation in intensity of the light of the night sky reported by Rayleigh and others with a maximum near midnight. (2) While no systematic studies of the variation of night-sky light with latitude exist, the measurements of Rayleigh show a slight decrease with latitude. This agrees with the apparently relatively weaker nocturnal *E* layer at Huancayo than in England. (3) The maximum in occurrence frequency and light intensity of polar aurora at 100 km agrees closely with the height of the *E* layer. Absence of correlation between *E* ionization and night-sky light would support the theory of Chapman that the energy source for the night-sky light is due to the recombination of dissociated oxygen atoms.

15. The Fine Structure of Hydrogen Isotopes. C. F. ROBINSON, *California Institute of Technology.*—The fine structure of deuterium has been studied by using a high frequency oscillator for electrodeless excitation and conventional cooling. One plate has been subjected to Fourier analysis according to the method developed by Houston. Results are in essential agreement with those of Houston in showing a displacement of the second and third components toward the strongest. In a determination of e/m based on the spectra of hydrogen and deuterium, it is necessary to know by what amounts the strong components of $H\alpha$ and $D\alpha$ are displaced, and it is now fairly generally agreed that the positions and intensities of the components of these lines are not in agreement with theory. The method of Fourier analysis is capable of giving the positions and separations of all the lines in the multiplet, and the results show that the strong component of $D\alpha$ is displaced by a negligible amount from the position of the maximum. With $H\alpha$ the displacement is still small because of the use of an interferometer separation such as to space the components uniformly along the pattern. A preliminary evaluation gave $e/m=1.7592\pm.0005$.

16. The Calculation of Internal Conversion Coefficients. S. M. DANCOFF AND P. MORRISON, *University of California.*—We generalize the calculation of internal conversion coefficients to γ-rays of arbitrary multipole order and type in the range $Z<40$ to help understand the spectra and the isomerism of artificially radioactive nuclei. The selection rules show that for nuclear transitions involving a change in angular momentum $J\to J'$, where $|J-J'|=L$, we may expect the radiation to be predominantly electric 2^L-pole+magnetic 2^{L+1}-pole, or electric 2^{L+1}-pole+magnetic 2^L-pole, depending on the parity change. We represent the potentials of a 2^L-pole in the Hansen-Heitler-gauge, in which $\operatorname{div} A=\varphi=0$. The singularities involved in this gauge introduce supplementary terms in the calculation of the matrix elements. We list formulae for certain limiting cases: If $\left\{\begin{matrix}\alpha_k{}^l\\ \beta_k{}^l\end{matrix}\right\}$ is the internal conversion coefficient for two K electrons for $\left\{\begin{matrix}\text{electric}\\ \text{magnetic}\end{matrix}\right\}$ 2^l-pole radiation, we find *neglecting binding:* $(n=Ze^2/\hbar v<<1)$

$$\alpha_k{}^l=\frac{2Z^5\alpha^4}{x^3}\left(\frac{x+2}{x}\right)^{l-\frac{1}{2}}\left[\frac{(l+1)x^2+4l}{l+1}\right],$$

$$\beta_k{}^l=\frac{2Z^5\alpha^4}{x^3}\left(\frac{x+2}{x}\right)^{l+\frac{1}{2}},$$

with $x=h\nu/mc^2$. When binding must be taken into account, closed formulae can be obtained only in the nonrelativistic limit. In particular, the asymptotic form for large l is:

$$\alpha_k{}^l=Z^5\alpha^4\frac{l}{l+1}\left(\frac{2}{x}\right)^{l+5/2}\left[1-2n\sqrt{l}\,\frac{(1+n^2+(1/2l)-n\mu/2)^l}{(2+l\mu^2)^{\frac{1}{2}}}\right]^2,$$

where $\mu=n+(n^2+2/l)^{\frac{1}{2}}$.

17. The Fine Structure of the Line λ4686 of Ionized Helium. DJEN-YUEN CHU, *California Institute of Technology.*—The fine structure of the line λ4686 of ionized helium, emitted at a pressure of about 0.3 mm from a hollow cathode cooled by liquid air, was measured with a Fabry-Perot interferometer at four different separations. The formula for the interferometer pattern expressed in Fourier series was applied in the analysis. Because of the overlapping, not all of the eight components predicted by theory could be resolved, but four of them were definitely observed, and the remaining weaker ones were inferred from the pattern to be present. The relative intensities and the positions of the eight components were found to be in general agreement with the theory. The wave-lengths of three strong components were 4685.7017±0.0004 I.A., 4685.8012±0.0005 I.A. and 4685.5298±0.0015 I.A. respectively, referred to the helium line 5015.6750 I.A. as standard. The separation between the two strongest components was 0.4529±0.0029 cm^{-1}, while the theoretical value calculated on the assumption that the fine structure constant $\alpha=1/137.0$ was 0.4556 cm^{-1}. The Rydberg constant for helium was calculated to be 109,722.430±0.010, neglecting any uncertainty in the index of refraction of air.

18. The Identification of X-Rays Emitted during the Decay of Radioactive Elements. PHILIP ABELSON, *University of California.*—It is now well known from absorption measurements that intense x-rays are emitted from many of the artificial radioactive isotopes; some are caused by electron capture and others by internal conversion of gamma-rays. By means of a suitably designed bent crystal spectrograph[1] the following x-rays have been identified. The x-rays associated with the disintegration of Ga^{67} were found to be those characteristic of zinc in confirmation of the absorption measurements of Alvarez.[2] The x-rays emitted in the decay of Cu^{64} were shown to be characteristic of Ni. X-rays characteristic of bromine were identified with the decay of the 4.5-hour period of Br^{80}.

[1] Bozorth and Haworth, Phys. Rev. **53**, 538 (1938).
[2] Alvarez, Phys. Rev. **54**, 486 (1938).

19. Photoconductivity of Crocoite Crystals. JAMES J. BRADY AND WILLIAM H. MOORE, *Oregon State College.*—Crocoite crystals were placed between two brass electrodes, one of which was connected to the grid of an FP-54 amplifier. The other electrode was connected to a battery. With an applied potential of 50 volts, the dark currents were in the order of magnitude of 10^{-11} ampere. When light from a carbon arc illuminated the crystal, the current increased 10^{-11} ampere. The current increased with time of illumination until it reached a maximum value after several minutes. When the light was turned off, the current immediately dropped to a small value, and then gradually reduced to zero after several minutes. Spectral distribution curves were obtained for different applied voltages. The spectral maximum was not shifted by a change of voltage. Some of the crystals showed a current, when illuminated, even though the external voltage was zero. Those which did not show this actinoelectric effect could be made to do so by first causing a current to flow through them by applying an external e.m.f. This activation process depended both on the applied potential and the length of time the current flowed through the crystal. Immediately after activation, the actinoelectric currents decreased with the time of illumination, but finally reached a constant value.

SUPPLEMENTARY PROGRAM

When two or more papers are offered by the same member one only of these will be assigned a place on the regular program while the others will be placed in a supplementary program to be called for if time permits.

Papers received after the program has been printed will be placed in the supplementary program.

The papers in the supplementary program may be called for only at the session indicated.

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